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The Domain Names Plan and Schedule

This RFC outlines a plan and schedule for the implementation of domain style names throughout the DDN/ARPA Internet community. The introduction of domain style names will impact all hosts on the DDN/ARPA Internet.

The Plan

Introduction

Domain style names are being introduced in the Internet to allow a controlled delegation of the authority and responsibility for adding hosts to the system. This also allows a subdivision of the task of maintaining information about hosts.

The subdivision will be based on administrative authority or organization boundaries (not necessarily network boundaries). Certain requirements will be placed on organizations wishing to be "top level" domains. Initially, all the hosts in the Internet will be in the domain "ARPA". As soon as is practical a second domain, "DDN", will be introduced. Other domains may be added after that, provided the requirements listed below are met.

Domain names will be supported in the long run by a system of special servers called "domain servers" which will be used to translate names to addresses. While this system of domain servers is being created and programs are being converted to use them, the existing host tables will evolve to include domain style names.

The domain server design also provides for mapping mailbox addresses to the host name of the mail server for that mailbox. This feature allows mailboxes to be related to an organization rather than to a specific host.

This plan will be implemented in the ARPA community. After the domain system is demonstrated in the ARPA community, the DDN Program Management Office (DDN-PMO) will determine the schedule for implementation of the domain system in the DDN community. This approach will cause some extra steps in the ARPA community implementation, and may limit communication between the ARPA and DDN communities in some ways. The details and implications of this two phase approach are discussed more fully below.

A Catch 22

There is a problem in introducing domain style names: a great deal of software has to be changed. Some groups would like to start using domain style names right away, and other groups don't want to see them or use them for a very long time. Communication patterns are very complex and as soon as domain style names are allowed and used by a few groups they will start showing up almost everywhere. This argues that everyone should be prepared for them before they are used at all. However, we know that with people being people and with so many of people involved, the probability of everyone being ready in any reasonable time period is nearly zero. The way out of this situation is to set up a reasonable schedule for experimenting with domain style names and authorizing their use. People that get ready on schedule should have no problems with these names.

Evolution of the Table

Nearly all the hosts in the Internet now use some form of host table based on the master file "HOSTS.TXT" maintained by the Network Information Center (NIC).

One way to introduce domain style names is to add to the entries in this table names in the domain style. In particular, make the first name in each entry the official host name in the ARPA domain.

For example, the current entry for USC-ISIF is:

```
HOST : 10.2.0.52 : USC-ISIF,ISIF : DEC-1090T : TOPS20 :
TCP/TELNET,TCP/SMTP,TCP/FTP,TCP/FINGER,UDP/TFTP :
```

This could become:

```
HOST : 10.2.0.52 : USC-ISIF.ARPA,USC-ISIF,ISIF : DEC-1090T :
TOPS20 : TCP/TELNET,TCP/SMTP,TCP/FTP,TCP/FINGER,UDP/TFTP :
```

For some hosts and programs this could be done today with no disruptions, but for others substantial problems could occur. For example, with over five hundred entries in the table the addition of 500 names could exceed the space allocated to store the table in some programs. (One could argue that these programs are going to blow up soon anyway as new host entries are added to the table.) Another problem is that period (or dot, ".") is not now a legal character in host names and some programs may not be able to parse these new names.

The plan is to make such a domain style name table available in parallel with the regular table for a few months, then to replace the regular table with this domain style table. The dates for these changes is given in the schedule below.

So far, no new domains have been introduced. Only a table with all the entries having official names in the ARPA domain has been provided. This should allow programs to be constructed to deal with domain style names in a general way without any special hacks to add or delete the string ".ARPA" to or from host names.

The introduction of new domains is tied to the provision of domain servers by those domains. As new domains meet the requirements and are authorized they will also be added to the host table. No new domains will be added before master table is converted to the domain style entries.

In the long run the Internet will become too complex and change too fast to keep a master table of all the hosts. At some point the master table will be reduced to simply the entries for the domain servers for the top level domains. By this time all normal translation of host names into addresses should take place by consulting domain servers.

Conversion to Servers

As soon as domain servers become available programs should be converted to use them to translate names into addresses. The details of these procedures are given in RFCs 882 and 883.

The general idea is that a host no longer keeps a complete host table but rather makes a request on the domain server each time a name must be translated to an address. The code module in the host that implements the protocol to do this is called a "resolver". The resolver may keep a cache of recently translated names and addresses for improved performance.

Many hosts have a library function or system call that is used to access the host table to translate names to addresses. It ought to be possible to replace this function or call with the resolver module such that most programs would not know which method was used to accomplish the name to address translation.

Requirements on a Domain

There are several requirements that must be met to establish a domain. In general it must be responsibly managed. There must be a responsible person to serve as a coordinator for domain related questions, there must be a robust name service, it must be of at least a minimum size, and the domain must be registered with the central domain administrator.

Responsible Person:

An individual must be identified who has authority for the administration of the names within the domain, and who takes responsibility for the behavior of the hosts in the domain in their interactions with hosts outside the domain.

The operation of a name server should not be taken on lightly. There are some difficult problems in providing an adequate service, primarily the problems in keeping the data base up to date, and keeping the service operating.

If some host in a domain somehow misbehaves in interactions with hosts outside the domain (e.g., consistently violates protocols), the responsible person for the domain must be able to take action to eliminate the problem.

Domain Servers:

A robust and reliable domain service must be provided. One way of meeting this requirement is to provide at least two independent domain servers for the domain. The data base can, of course, be the same. The database can be prepared and copied to each domain server. But, the servers should be in separate machines on independent power supplies, et cetera; basically as physically independent as can be and yet in the same domain. They should have no common point of failure.

One of the difficult problems in operating a domain server is the acquisition and maintenance of the data. In this case the data is the host names and addresses. In some environments this information changes fairly rapidly and keeping up-to-date data may be difficult. This is one motivation for sub-domains. One may wish to create sub-domains until the rate of change of the data in a sub-domain domain server data base is easily managed.

The concepts and implementation details of the domain server are given in RFCs 882 and 883.

Minimum Size:

The domain must be of at least a minimum size. Several measures of size may be used in combination in making this test. Measures may include: (a) the number of host computers in the domain, (b) the number of people with primary mailboxes in the domain, (c) the amount of traffic that crosses the boundary of the domain [packets/day or mail items/week]. Specific threshold values for these measures will be established before new domains are authorized.

There is no requirement to form a domain because some set of hosts is above the minimum size.

Registration:

The administrator must register the domain with the central authority. The central authority must be satisfied that the requirements are met before authorization for the domain is granted.

The administrator of a domain is required to make sure that host and sub-domain names within that jurisdiction conform to the standard name conventions and are unique with in that domain.

If sub-domains are set up the administrator may wish to pass along some of his authority and responsibility to a sub-domain administrator.

Mailbox Support

The design of the domain servers provides two levels of support for mail.

The first, called "agent binding", is that the right hand part of the typical mail box (Y in X@Y) can be mapped a host that will either accept the mail as the destination or accept the mail for forwarding.

The second, called "mailbox binding", is to map the entire mailbox (X@Y) to a destination (this mechanism can also support some mailing list functions).

Agent binding can be used to establish mailboxes that are based on an organization name rather than a host name.

For example, an organization, "BLAT", with hosts "BLAT-20" and

"BLAT-VAX" in the ARPA domain could set up mailboxes of the form "user@BLAT.ARPA" and use the domain server mechanisms for mapping these to the host that accepts the mail for the organization.

Mailbox binding will allow different mappings for individual mailboxes of an organization or host to the destination host. It will also provide for aliases and mailing groups.

Mailbox binding requires adding information on individual mailboxes to the domain server database. This could be a substantial increase in the database size and management responsibility.

The ARPA Community and the DDN Community

This plan will be put into effect in the ARPA community.

The DDN community will adopt the domain style names, but will continue with the present scheme of a centrally maintained table copied periodically by each host. Once the use of domain servers has been demonstrated by use in the ARPA community, the DDN-PMO will establish a schedule for implementing the domain system in the DDN community.

This means that there may be a period of a year or more with the two communities using different schemes for distributing information about host names and addresses.

Specifically:

The NIC will maintain a table a "HOSTS.TXT" style table for use by DDN hosts. This table will contain domain style names for all DDN hosts (e.g., USC-ISIA.DDN). Since this is the only information DDN hosts will use to translate host names to Internet Addresses, this table must also contain names and addresses of ARPA community hosts of interest to DDN users (e.g., USC-ISIF.ARPA).

There will be a domain server with data for the DDN domain. That is, hosts in the ARPA community that use the domain system of resolvers and servers will be able to access servers that have the data base covering the DDN community.

It is quite likely that the table for the use of the DDN hosts will be incomplete with respect to coverage of the ARPA community and any new domains that are established. One motivation for the domain system is the subdivision of name management to avoid the

difficulty of keeping a global table of all hosts. As the ARPA community moves to significant use of the domains system the maintenance of a global table for use by the DDN community will become very difficult.

This means that DDN hosts might not be able to look up the names of some ARPA community hosts in their local tables. In some cases this might result in an inability establish communication from a DDN hosts to such "unknown" ARPA community hosts.

The most likely case is for a computer mail message sent from an ARPA community user on a host know to name servers but not in the central table to a user on a DDN community host that relies on a local copy of the central table. When the DDN user attempts to answer this message his mail program will attempt to look up the host name. This will fail, and the most likely result is that the mail program will tell the user that there is no such host!

Please note that DDN community hosts are permitted (even encouraged) to implement the domain system in parallel with the ARPA community. However, there is no requirement that they do so until called for in the schedule to be established by the DDN-PMO.

The Schedule

04-Oct-83 The ARPANET/MILNET Logical Split

02-Nov-83 Publish Domain Name Documents

This Plan and Schedule (RFC-881), Domain Names - Concepts and Facilities (RFC-882), and Domain Names - Implementation Specification (RFC-883).

16-Nov-83 Make Available Domain Style Host Table

Create a copy a modified version of the HOSTS.TXT table named DHOSTS.TXT with an additional name (as the first name) in each entry of the form "official-host-name.ARPA".

15-Dec-83 Final Specification of simple Query & Reply Protocol Available

This specification covers the protocol procedures and message formats for the simple queries and replies to support translating host names to internet addresses only.

15-Dec-83 Make Limited Domain Server & Resolvers Available

An example limited domain server running on TOPS-20 and example limited resolvers running on each of TOPS-20 and VAX-Berkeley-Unix should be made available for testing and copying. This simple version would be able to do queries and responses for host name to internet address translation only, and the servers would still use the global table. This simple server would not refer the resolver to another server. This simple server and these resolvers operate in datagram mode only. However, this would allow user programs to begin to use the servers.

01-Feb-84 Specification of Domain Requirements Available

Detailed requirements for qualifying a set of hosts as a domain, and procedure for registering new domains is published.

15-Feb-84 The ARPANET/MILNET Access Controls

MILNET access controls installed in the MILNET/ARPANET gateways and TAC user access controls put into effect (see DDN MGT Bulletin 16). [Date approximate.]

07-Mar-84 Replace Main Host Table with Domain Style Host Table

The DHOSTS.TXT becomes HOSTS.TXT.

14-Mar-84 Final Specification of Query & Reply Protocol Available

This specification covers the protocol procedures and message formats for the all queries and replies between resolvers and servers.

14-Mar-84 Make Improved Domain Servers & Resolvers Available

An example improved domain server running on TOPS-20 and example improved resolvers running on each of TOPS-20 and VAX-Berkeley-Unix should be made available for testing and copying. This version should be able to do any of the defined query and response operations, and should support segmented data base by refering resolvers to other servers if necessary. This server loads zone data from local master files only, and only at program start up. This server and these resolvers operate with either datagram or reliable connection style communication. This version does not support the data base update portion of the server protocol.

04-Apr-84 Domain Servers for ARPA Domain Available

Authoritative domain servers for the ARPA domain will be available for regular use.

02-May-84 Introduce New Domains in the Main Host Table

Add the DDN domain. Most MILNET hosts will change to the DDN domain. Authoritative domain servers for the DDN domain will be available for regular use. HOSTS.TXT is updated.

02-May-84 Establish a New Top Level Domains Only Table

Start a new table, DOMAINS.TXT, that lists only the top level domains and the entries for their domain servers.

16-May-84 Final Specification of Maintenance Protocol Available

This specification covers the protocol procedures and message formats for the data base update exchanges between servers.

16-May-84 Make Improved Domain Servers & Resolvers Available

An example improved domain server running on TOPS-20 and example

improved resolvers running on each of TOPS-20 and VAX-Berkeley-Unix should be made available for testing and copying. This version should be able to do any of the defined query and response operations, and should support segmented data base by refering resolvers to other servers if necessary. This server loads zone data from local master files and remote servers, and only at program start up. This server and these resolvers operate with either datagram or reliable connection style communication.

06-Jun-84 Permit the Introduction of New Domains

Organizations meeting the requirements for establishing new domains will be allowed to begin use of new domain names. New domains must be registered, meet the requirements (including running domain servers), and will be added to the HOSTS.TXT table.

18-Jul-84 Final Specification of Complete Protocol Available

This specification covers the protocol procedures and message formats for the complete domain names system.

18-Jul-84 Make Full Domain Servers & Resolvers Available

At this point an example domain server and an example resolver running on each of TOPS-20 and VAX-Berkeley-Unix should be made available for testing and copying. This version should be able to do any of the defined query and response operations, and should support segmented data base by refering resolvers to other servers if necessary. This version should support the data base update portion of the server protocol, including data aging and dynamic zone updating from remote servers. This is a full implementation of the protocol.

05-Sep-84 Discontinue the Full Host Table for the ARPA Community

Stop maintaining the HOSTS.TXT table for the ARPA community. The HOSTS.TXT table continues to be used in the DDN community with complete data for the DDN domain, however the data for the ARPA and other domains may no longer be complete or fully up to date.

03-Oct-84 DDN-PMO Schedules DDN Implementation

The DDN-PMO establishes the schedule for the implementation of the domain system in the DDN community.